In the Claims

The listing of claims presented below will replace all prior versions and listings of claims in the Application:

1. (Currently Amended) A method of autocalibrating a quantum key distribution (QKD) system having ~~two~~ first and second encoding stations, a laser and a single-photon detector (SPD) unit, comprising:

a) performing ~~a~~ laser gate ~~scan~~ scanning by:

i) sending ~~a~~ laser gating ~~signal~~ signals to the laser to cause the laser to generate photon signals;

~~and~~ ii) varying an arrival time T of the laser gating signals over a first range R1 to vary times at which the photon signals are generated;

iii) exchanging the photons signals between the first and second encoding stations and performing first and second encodings of the photon signals at the first and second QKD stations, respectively;

ii) ~~to determine~~ detecting the encoded photon signals at an SPD unit in one of the first and second encoding stations so as to generate photon counts and determining an optimal arrival time T_{MAX} of the laser gating signals that corresponds to a first optimum number of photon counts ~~from the SPD unit for photon signals generated by the laser and exchanged between the two encoding stations~~; and

b) performing laser gate dithering by varying the arrival time T of the laser gating signals over a second range R2 surrounding T_{MAX} to maintain either the first optimum number of photon counts or a second optimum number of photon counts.

2. (Currently Amended) The method of claim 1, wherein at least one of the first ~~and/or~~ and second optimum number of photon counts is/are either:

i) a maximum number of detected photons N_{MAX}, or ii) a maximum of the total number of photon counts N detected over a time interval divided by a number of double-clicks from the SPD unit over the time interval.

3. (Original) The method of claim 1, including:

terminating the laser gate dithering and performing another laser gate scan.

4. (Currently Amended) The method of claim 1, wherein the QKD system includes a programmable controller and a computer readable medium, wherein the laser gating ~~signal is~~ signals are provided by the controller, and wherein the method is embodied in the computer readable medium such that the controller is capable of directing the QKD system to carry out acts a) and b).

5. (Currently Amended) A computer-readable medium having instructions embodied therein to direct a computer in a quantum key distribution (QKD) system having first and second encoding stations and a laser to perform the following method of actively autocalibrating the QKD system:

a) performing ~~a~~ laser gate ~~scan~~ scanning by:

i) sending laser gating signals to the laser to cause the laser to generate photon signals;

~~and~~ ii) varying an arrival time T of the laser gating signals over a first range R1 to vary times at which the photon signals are generated;

iii) exchanging the photons signals between the first and second encoding stations and encoding the photon signals at the first and second QKD stations, respectively;

ii) ~~to determine~~ detecting the encoded photon signals at an SPD unit to generate photon counts and determining an optimal arrival time T_{MAX} of the laser gating signals that corresponds to an optimum number of photon counts from ~~an~~ the SPD unit; and

b) performing laser gate dithering by:

i) varying the arrival time T of the laser gating signals over a second range R2 surrounding T_{MAX} to maintain the optimum number of photon counts ~~as optimum~~.

6. (Previously Amended) The computer-readable medium of claim 5, wherein the optimum number of photon counts is either:

i) a maximum number of photons N_{MAX}, or ii) a maximum of the total number of photon counts N over a time interval divided by a number of double-clicks from the SPD unit over the time interval.

7. (Currently Amended) A method of exchanging ~~a key~~ photon signals in a quantum key distribution (QKD) system having a laser and ~~an~~ a single-photon detector (SPD) ~~SPD~~ unit both operably coupled to a controller, comprising:

encoding and exchanging the photon signals between first and second encoding stations in the QKD system, where the photon signals are generated by the laser in response to laser gating signals;

performing a first laser gate scan by sending the laser gating signals from the controller to the laser over a range R1 of laser gating signal arrival times T;

establishing from the first laser gate scan a first optimal arrival time T_{MAX} for the laser gating signal corresponding to a first maximum number of photon counts N_{MAX} from detecting the encoded photon signals at the SPD unit;

terminating the first laser gate scan when the first optimal arrive time T_{MAX} is established; and

performing a first laser gate dither by altering the arrival time T over a range of arrival times R2 about the first optimal arrival time T_{MAX} to maintain either the first maximum number of photon counts N_{MAX} or a different maximum number of photon counts N'_{MAX} over the range R2.

8. (Previously Amended) The method of claim 7, wherein performing the first laser gate dither results in a new optimal arrival time T'_{MAX}.

9. (Currently Amended) The method of claim 7, further including:

terminating the performing of the first laser gate dither; ~~and~~

performing a second laser gate scan;

terminating the second laser gate scan; and

performing a second laser gate dither.

10. (Original) The method of claim 7, further including terminating and repeating the first laser gate dither periodically so as to perform a series of laser gate dithers.

11. (Currently Amended) A computer-readable medium having instructions embodied therein to direct a computer in a quantum key distribution (QKD) system

adapted to control the operation of the QKD system to perform the following method of actively autocalibrating a the QKD system, the method comprising:

sending photon signals between first and second encoding stations in the QKD system, wherein the photon signals are generated by a laser in response to laser gating signals having associated arrival times T at the laser and respectively encoded by the first and second encoding stations to form encoded photon signals;

performing a first laser gate scan by varying the arrival time T over a first range of arrival times R1 to establish a first optimal arrival time T_{MAX} corresponding to a first maximum number of photon counts N_{MAX} from a detector unit in one of the QKD stations and that is configured to detect the encoded photon signals;

terminating the first laser gate scan when the first T_{MAX} is established; and

performing a first laser gate dither by altering the arrival time T over a second range of arrival times R2 < R1 about the first T_{MAX} to maintain either a) the first maximum number of photon counts N_{MAX}, or b) a different maximum number of photon counts N'_{MAX} over the second range R2.

12. (Currently Amended) A method of autocalibrating a quantum key distribution (QKD) system having a laser, a single-photon detector (SPD) unit and controller operably coupled to the laser and the SPD unit, comprising:

generating photon signals with the laser by activating the laser with laser gating signals sent from the controller, the laser gating signals having an associated laser gating signal timing T;

sending the photon signals between first and second encoding stations in the QKD system so as to encode the photon signals;

performing a first laser gate scan to determine an optimum arrival time T_{MAX} for the laser gating ~~signal~~ signals to arrive at the laser by obtaining a first optimum number of photon counts of the encoded photon signals detected at the SPD unit;

terminating the first laser gate scan when T_{MAX} is determined ~~established~~; and

periodically dithering the laser gating signal arrival time about T_{MAX} to maintain either the first ~~an~~ optimum number of photon counts or a second optimum number of photon counts.

13. (Previously Amended) The method of claim 12, further including:

terminating the laser gating signal dithering; and

performing another laser gate scan.

14. (Currently Amended) The method of claim 12, wherein at least one of the first ~~and/or~~ and second optimum number of photon counts ~~is/are~~ is a maximum number of photon counts.

15. (Currently Amended) A method of actively autocalibrating a quantum key distribution (QKD) system having ~~two~~ first and second encoding stations, and a laser coupled to a controller in one of the encoding stations, the method comprising:

generating photon signals from the laser by sending laser gating signals from the controller to the laser;

exchanging the photons signals between the first and second encoding stations and performing first and second encodings of the photon signals at the first and second encoding stations, respectively, thereby forming encoded photon signals;

~~performing a laser gate scan to establish~~ establishing an optimum arrival time of a the laser gating ~~signal~~ signals at the laser that corresponds to a first optimum number of photon counts from a single-photon detector (SPD) unit in one of the encoding stations ~~when~~ and configured to detect the encoded photon signals ~~between the encoding stations~~;

terminating the laser gate scan; and

~~performing a laser gate dither process by~~ varying the arrival time of the laser gating ~~signal~~ signals around the optimal arrival time in order to provide minor adjustments to the arrival time that lead to the SPD unit yielding either the first optimum number of photon counts, or a second optimum number of photon counts.

16. (Currently Amended) The method of claim 15, wherein at least one of the first ~~and/or~~ and second optimum number of photon counts is either a maximum number of photon counts, or a maximum of a total number of photon counts for a given interval divided by a number of double-clicks in the same interval.

17. (New) The method of claim 1, wherein the photon signals are phase-encoded by a first phase modulator in the first QKD station and a second phase modulator in the second QKD station.

18. (New) The method of claim 1, further including:

encoding a first photon signal in the first QKD station;

encoding a second photon signal in the second QKD station;

interfering the first and second encoded photon signals to form a combined pulse; and

wherein detecting the encoded photon signals comprises detecting the combined pulse.

19. (New) The method of claim 12, including generating the photon signals and detecting the encoded photon signals in the same encoding station.

20. (New) The method of claim 15, including generating the photon signals and detecting the encoded photon signals in the same encoding station.